

Please type a plus sign (+) inside this box →

PTO/SB/05 (4/98)

Approved for use through 09/30/2000. OMB 0651-0032

Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. 501.37892X00

First Inventor or Application Identifier Yoko IKEDA, ET AL.

Title See 1 in Addendum

Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. Specification [Total Pages 28]
 - Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. Drawing(s) (35 U.S.C. 113) [Total Sheets 16]
4. Oath or Declaration [Total Pages 2]
 - a. Newly executed (original or copy)
 - b. Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. DELETION OF INVENTOR(S)
Signed statement attached deleting
inventor(s) named in the prior application,
see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

* NOTE FOR ITEMS 1 & 13 IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

5. Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - a. Computer Readable Copy
 - b. Paper Copy (identical to computer copy)
 - c. Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. Assignment Papers (cover sheet & document(s))
8. 37 C.F.R. §3.73(b) Statement Power of
(when there is an assignee) Attorney
9. English Translation Document (if applicable)
10. Information Disclosure Statement (IDS)/PTO-1449 Copies of IDS
Citations
11. Preliminary Amendment
12. Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. * Small Entity Statement(s) Statement filed in prior application
(PTO/SB/09-12) Status still proper and desired
14. Certified Copy of Priority Document(s)
(if foreign priority is claimed)
15. Other:

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

Continuation Divisional Continuation-in-part (CIP) of prior application No _____ /

Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

<input checked="" type="checkbox"/> Customer Number or Bar Code Label	020457 (Insert Customer No. or Attach bar code label here)	or <input type="checkbox"/> Correspondence address below
Name		
Address		
City	State	Zip Code
Country	Telephone	Fax

Name (Print/Type)	Carl L. Brundidge	Registration No. (Attorney/Agent)	29,621
Signature		Date	12/01/99

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

12/01/99
JCT10 U.S. PTO
09/45249
jct564 U.S. PTO

12/01/99
Barcode

Addendum

1. INSPECTING METHOD, INSPECTING SYSTEM, AND METHOD FOR MANUFACTURING ELECTRONIC DEVICES

TITLE OF THE INVENTION

INSPECTING METHOD, INSPECTING SYSTEM, AND METHOD FOR
MANUFACTURING ELECTRONIC DEVICES

BACKGROUND OF THE INVENTION

The present invention relates to an analyzing unit, an inspecting system and a manufacturing method using the inspecting system which are applied to the production line of electronic devices and the like, and particularly to an analyzing unit, an inspecting system and a manufacturing method using the inspecting system, which efficiently classify images obtained as a result of inspection to thereby shorten an analysis time for failure and to enable enhancement of manufacturing efficiency and rapid yield ramp-up.

An electronic device, typically a semiconductor, is formed by repeating a plurality of processing steps of exposure, development, etching and the like on a wafer substrate. On the other hand, for wafers processed in a certain processing step out of the plurality of processing steps, information on the position, size, number, category, etc. of foreign matters adhered to the wafer and appearance failures, and information on processing dimensions of workpieces (hereinafter generally referred to as defects) are collected by a foreign matter inspecting apparatus, an optical visual inspection apparatus, and an inspecting

apparatus such as SEM, if necessary. In Monthly Publication, "Semiconductor World", 1996.8, pp 88, 99 and 102 it is described that all the inspecting data are normally sent from the inspecting apparatus to the analyzing system through a network for control and analysis.

Further, in the plurality of processing steps, an electronic microscope or the like is used to specify the cause of occurrence of the defects to obtain a defect image and perform the classifying operation on the basis of shapes and sizes of the actual defects. This classifying operation is carried out visually on the screen of a personal computer or the like, defect images are sampled on the basis of the size, the shape and the like of the defects, and then classified into a group of similar defects. It is noted that for defects to be sampled, several numbers of defects per wafer are manually determined referring to the distribution of defects a wafer map. Recently, several hundreds of defect images per hour are automatically obtained by an automatic defect review (ADR) of defect images. Anyway, the number of samples images handled has a tendency to increase.

SUMMARY OF THE INVENTION

However, a user interface (image display) in the classifying operation is not sufficiently reviewed. Therefore, it is difficult to efficiently classify a number

of detected images, not only requiring an extensive time for the classifying operation but having a tendency to lower the analysis accuracy also. The number of images detected in the future is expected to increase, and it has been an important problem to enhance a convenience in the classifying operation to shorten the classifying operation time. Further, there was a possibility that the requirement of long terms for the classifying operation brings forth a delay of a feedback operation and a great hindrance to a yield of the production line.

It is an object of the present invention to shorten the analysis time and enhance the analysis accuracy by improving the user interface. Further an object of the invention is to thereby enhance the yield of the production line.

For achieving the aforementioned objects, according to the present invention, there is provided an inspecting system comprising an analyzing unit, said analyzing unit including an image detection device for photographing a plurality of images in a workpiece; a storage means for storing detected images detected by said image detection device; and a display means having a first area for displaying a plurality of detected images stored in said memory means and a plurality of second areas for classifying said detected images according to features of said detected images; wherein said plurality of detected

images can be moved on a screen from said first area to said corresponding second areas to classify said plurality of detected images in said second areas.

Further, there is provided an analyzing unit comprising a storage means for storing a plurality of detected images; and a display means having a first area for displaying a detected image stored in said storage means and a plurality of second areas for classifying said detected images according to features of said detected images; wherein said plurality of detected images can be moved on a screen from said first area to said corresponding second areas to classify said plurality of detected images in said second areas.

Further, there is provided a method for manufacturing an electronic device wherein use is made of a manufacturing apparatus for processing a workpiece to be an electronic device; an inspecting apparatus for inspecting the workpiece processed by said manufacturing apparatus; and an analyzing unit including an image detection device capable of photographing an image of said workpiece, a storage means for storing detected images detected by said image detection device, and a display means having a first area for displaying a detected image stored in said storage means and a plurality of second areas for classifying said detected images according to features of said detected images, whereby said plurality of detected images can be

moved on a screen from said first area to said corresponding second areas to classify said plurality of detected images in said second areas; wherein the production line having said manufacturing apparatus arranged thereon is controlled using information obtained from said analyzing unit to process the workpiece.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view showing a defect image display and classification function showing one embodiment of the present invention;

FIG. 2 is a system constitutional view showing one embodiment of the present invention;

FIG. 3 is a classification operation processing flow chart showing one embodiment of the present invention;

FIG. 4 is a view showing a data example before classification in one embodiment of the present invention;

FIG. 5 is a view showing a display screen before classification in one embodiment of the present invention;

FIGS. 6(a) and 6(b) are views showing a display screen during classification in one embodiment of the present invention;

FIGS. 7(a) and 7(b) are views display screen during classification in one embodiment of the present invention;

FIG. 8 is a view showing a display screen during classification in one embodiment of the present invention;

FIG. 9 is a view showing a display screen during classification in one embodiment of the present invention;

FIG. 10 is a view showing a display screen after classification in one embodiment of the present invention;

FIG. 11 is a view showing a data example after classification in one embodiment of the present invention;

FIG. 12 is a classification operation processing flow chart showing one embodiment of the present invention;

FIG. 13 is a view showing a display screen during classification in one embodiment of the present invention;

FIG. 14 is a view representative of functions used for automatic classification in one embodiment of the present invention;

FIG. 15 is a view showing a display screen during classification in one embodiment of the present invention; and

FIG. 16 is a view showing a defective classification result analyzing function in one embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

FIG. 1 is a view showing a display and classification function of a detected defect image on a PC

(Personal Computer) display screen equipped with an analyzing unit.

In the figure, reference numeral 101 designates a display screen of PC. Numeral 151 designates an unclassified image display area for displaying an image not subjected to classification operation out of detected defect images. Numeral 102 designates detected individual defect images in the unclassified image display area 151. Numerals 152 to 155 designate classification areas for classifying defect images. Numerals 103 to 106 designate defect images having corresponding features to the classification areas 152 to 155 respectively. For example, numerals 103, 104, 105, and 106 designate a defect image having a white and round defect feature, a black and round defect image, an elongated defect image, and a large defect image, respectively. Numeral 107 designates a processing button for executing a preassigned function. As will be understood from FIG. 1, the present embodiment is designed so that a classification area for classifying defect images is provided on a screen, and typical images and classified images are displayed on the screen. Therefore, in the case where the detected defect images are classified, even if a number of defect images having complicated shapes are displayed, a user will suffice to merely move the defect images to the optimal classification area indicative of similar visual features, thus enabling carrying out the

classification operation easily and quickly. In particular, since the classification operation can be carried out by a drag and drop using a mouse or the like on the screen, the classification operation can be done while looking at all the defect images on the display screen, the classification operation can be performed while relatively comparing all the defect images, and its operativeness is excellent. The detailed operation will be described later.

FIG. 2 is one mode of a system constitutional view for realizing the present invention.

In this figure, reference numeral 201 designates an image detecting device; 202 a storage unit; 203 and 204 display/analyzing devices; 205 a system control computer; and 206 a network such as LAN in a factory. The storage unit 202 either may be connected to an image detecting device, or may be connected to a separate apparatus on the network, for example, the image detecting device 201. It is noted that the display/analyzing function as shown in FIG. 1 can be mounted on the image detecting device 201, or mounted on the computer connected to the image detecting device 201, or mounted on the display/analyzing device 204 in an office or the like physically away therefrom, but in the present embodiment, the function thereof is mounted on the display/analyzing device 203. A plurality of image detecting devices 201 may be installed, though not shown, in which case the system control computer 205 is able to

distribute the feature set and adjusted to each image detecting device 201. Thereby, in classification at each image detecting device 201, the features can be standardized. The setting and adjustment of the features will be described later.

FIG. 3 is a classification operation processing flow in the inspection system shown in FIG. 2.

First, the image detecting device 201 detects 100 to 300 defect images in a single wafer (Step 300). The detected defect images are temporarily stored in a memory of the image detecting device 201 with a defect location coordinate corresponded to its defect image on the wafer (Step 301).

Next, the image detecting device 201 calculates the features of the detected images stored in the memory (Step 302). For example, it calculates numerical values that the size, color, shape and the like of the detected images have.

When the features of the detected images are calculated, a data format as shown in FIG. 4 is generated, which is transmitted to the storage unit 202 (Step 303). The data format shown in FIG. 4 is constituted so that coordinate of defects, date and time of operation, the name of the corresponding detected image, features, and classification categories showing information in the case where the detected images are classified can be described. In this case, since the classification operation of

detected images is not yet carried out, information showing unclassification is described in the classification category. Alternatively, it may be constituted so that inspection results of detected images or the like are directly transmitted to the storage unit 202, and the storage unit 202 carries out calculation of the features and production of the data format. Further, alternatively, it may be constituted so that the image detecting device 201 also carries out the calculation of features of the detected images.

In this manner, image information, which includes the information, such as the image itself, position, detecting condition, feature and category, collected every wafer are sequentially stored in the storage unit 202.

Now, in the case where a user carries out the classification for the image information, first, the display/analyzing device 203 obtains the image information shown in FIG. 4 from the storage unit 202 (Step 304). For example, identification information such as wafer numbers to be subjected to the classification operation is input into the display/analyzing device 203, and corresponding image information is obtained from the storage unit 202.

The display/analyzing device 203 which has obtained the image information displays the detected defect images on the unclassified image display area 151 (Step 305). FIG. 5 shows its display example, in which 20 defect images

having various shapes, sizes, and colors are displayed.

Next, there is prepared a classification area 152 for classifying defect images as shown in FIG. 6(a) (Step 306). In this preparation, a classification area displayed on the display screen is related to a category of the area as shown in FIG. 6(b). That is to say, each area in the display screen is characterized, and the category (features) related as in FIG. 6(b) is imparted to the defect image classified into the area. In FIG. 6(b), the fact that the category is white is imparted to defect images positioned at area coordinates (000160, 000020) (000220, 000100) of the classification area 152. However, in FIG. 6(b), since the defect images are not moved on the display screen from the unclassified image display area 151 to the classification area 152 on the display screen, attached image names are not described on the column applicable to the classification area 152. Further, the fact that the category is unclassified is imparted to defect images positioned inside the coordinates (000010, 000020) (000150, 000400) of the unclassified image display area 151. Accordingly, in FIGS. 6(a) and 6(b), all the defect images are described as the unclassified. Area attribute information shown in FIG. 6(b) is information stored within the display/analyzing device 203. Further, information of an attached image shown in FIG. 6(b) is not always necessary, but it will suffice that at least the

classification area and the attribute (category) of the area are recognized.

Next, a typical defect image indicative of the characteristic of the classification area 152 is moved from the unclassified image display area 151 to a typical defect display area 402 as shown in FIG. 7(a) (Step 307). For example, the corresponding defect image present in the unclassified image display area 151 is clicked by a mouse, and moved to the typical defect display area 402 by a drag and drop. In this case, in area category information shown in FIG. 7(b), a moved defect image IMG001 is described in the column of the area coordinates (000160, 000020) (000220, 000100), category "white". Alternatively, it is natural that the actual defect image is not moved from the unclassified image display area 151, but a schematic image may be displayed. In this case, a plurality of schematic images as desired are produced in advance, and the thus produced images may be introduced into the typical defect display area 402. Alternatively, also, the typical defect image or images are not displayed on the typical defect display area 402, but text information representative of the features may be displayed.

Then, similar unclassified defect images are classified from the unclassified image display area 151 into the classification area 152 while referring to typical defect images displayed on the typical defect display area

402 (Step 308). For example, the applicable defect image present in the unclassified image display area 151 is clicked by a mouse, and moved to the classification area 152 by a drag and drop. In FIG. 8, defect images IMG005 and IMG010 are classified. Similarly, the classification areas 153, 154, 155 are defined as shown in FIG. 9, and unclassified defect images similar to the typical defect image are classified from the unclassified image display area 151 to the classification areas 152, 153, 154, 155 whereby the classification operation with respect to all the defect images is carried out. FIG. 10 is a display screen showing the classification results. While in this case, four kinds of classification areas were provided for classification operation, it is noted that the contents and the number of the categories are changed as necessary.

Next, a data format shown in FIG. 11 is produced from the classified results shown in FIG. 10 (the data format shown in FIG. 4 is updated), and transmitted from the display/analyzing device 203 to the storage unit 202 (Step 309). For example, corresponding attribute information is obtained from a position on the display screen on which the defect image is arranged on the basis of the area attribute information shown in FIG. 6(b) at a fixed timing after completion of the classification operation or during the classification operation, and a classification category shown in FIG. 11 is updated. Also

in this case, the classified result per wafer unit is transmitted.

Since as described above, the classification area for classifying the defect images is provided on the screen, and the typical image is displayed on the screen, even if when the detected defect images are classified, a plurality of defect images having a complicated shape should be displayed, the user will suffice to merely move the defect images to the optimal classification area showing similar visual features, thus enabling execution of the classification operation easily and quickly. In particular, since the classification operation can be done by a drag and drop using a mouse on the screen, the classification operation can be carried out while looking at all the defect images on the display screen, and the classification operation can be performed while relatively comparing all the defect images to provide an extremely excellent operativity.

Next, an example will be described in which unclassified defect images are automatically classified, and the classified results are corrected to classify the defect images. The automatic classification and the correcting function are combined so that the defect images are roughly automatically classified, after which correction is added, whereby it is possible to shorten the operating time of the classification operation and to

enhance the classification accuracy. FIG. 12 shows a processing flow thereof.

A plurality of classification areas are preset for automatic classification. For example, classification areas 152 to 155 are prepared in the procedure similar to that as described previously as shown in FIG. 13. Also in this case, the classification areas displayed on the display screen are related to the attributes thereof. The area attribute information is stored in a display/analyzing device 203.

Further, functions for automatic classification are stored in the display/analyzing device 203. This function is provided to calculate to which category the features of the defect image belongs. FIG. 14 schematically shows the functions. This represents the function between an area of the defect image and the gray-scale value thereof and calculates at which area the features of the defect image is positioned in the figure. For example, if the feature is positioned in a certain position relative to (tA, uA) as a center, the defect image thereof is calculated as a category A. While FIG. 14 shows a secondary function of the area and the gray-scale value, it is to be noted that other parameters may be used, or multifunction such as cubic or quadratic may be used.

Next, the display/analyzing device 203 obtains the detected result shown in FIG. 4 from the storage unit 202

and displays the detected defect image on the unclassified image display area 151 (Step 1201). The processing until the display/analyzing device 203 displays the detected defect image on the unclassified image display area 151 is similar to that of the example previously mentioned, the detailed description of which is omitted.

Next, the automatic classification starts on the defect image displayed on the unclassified image display area 151 (Step 1202). That is, category under which the feature of each defect image falls is calculated on the basis of the function stored in the image detecting device 201 (Step 1203).

When the category is calculated, the defect image is moved to the corresponding classification area on the display screen on the basis of the aforementioned area attribute information (Step 1204). FIG. 15 is a view showing a display screen after movement. With respect to the defect image that cannot be subjected to image processing according to the picking up conditions to fail obtaining the features, or the defect image which does not fall under any category, the defect image is moved from the unclassified area to a specific classification area manually using a mouse or a keyboard for classification operation.

In the case where the classification for all the images is completed (Step 1205), the classified result is

confirmed (Step 1211), and whether or not the classified result is corrected is judged on the screen (Step 1212). The correction of the classified result is shown in FIG. 15. In FIG. 15, in the case where a defect image A is corrected in category from a classification area 155 to a classification area 153, for example the defect image A present in the classification area 155 is clicked by a mouse (Step 1206) to move the corresponding classification area 152 by a drag and drop, thus enabling easy correction of the classified result (Step 1209). Alternatively, in the case where no corresponding category is present, a category may be newly added (Step 1208).

The aforementioned processing is carried out on all the defect images to complete the classification operation (Step 1210). FIG. 10 shows a display screen showing the corrected result. When the classification operation is completed, category information about the defect images is updated (Step 1213), and the updated result is transmitted to the storage unit 202. In the case where the automatic classification is not completed for all the defect images, that is, in the case where defect images that cannot be automatically classified are present (Step 1205), the procedure is shifted to the classification operation by way of manual classifications shown in Steps 206 to 212.

Since also in this embodiment, the corresponding category information is obtained from the position on the

display screen on which defect images are arranged in accordance with the area attribute information stored in advance, the correction of the classification category for the defect image can be carried out easily. In other words, since the corresponding category information is obtained from the position on the display screen on which defect images are arranged, even if a correction or the like should occur, the user will suffice to merely move the defect image on the display screen, and the classification operation including the correction can be realized very easily, enhancing a convenience in use.

Finally, an analyzing example using the above classified results will be explained below.

In analyzing the classified results, the applicable classified result is obtained from the storage unit 202 in the display/analyzing device 203. FIG. 16 shows one example of analyzing screens thereof. Numeral 1601 designates a position of the detected defect image from the classified results shown in FIG. 11, showing a defect distribution on the wafer. Numerals 1602 and 1603 designate the defect images on the wafer, the imaging conditions and the like. Numeral 1604 designates a classification result display area, in which the classified results relative to the applicable defect images are collected on the spot to display the results thereof. For example, the number of occurrences and the rate of

occurrence according to categories are calculated from the classified results shown in FIG. 11 and displayed.

Although not shown, further, a specific category is selected whereby defects on a wafer with the category are shown understandably according to colors on the position 1601. Here, defects of applicable categories are extracted using the classified results shown in FIG. 11, and the positions of the defects on the wafer are extracted to enable the display of the positions by colors as desired.

Although not shown, alternatively, the classified results may be displayed by a circular graph, a broken-line graph or a bar graph according to categories. These displays may be output to separate windows or may be displayed simultaneously on the window. Further, these may be printed out for the purpose of making reports, or data may be output to files or the like.

The cause of occurrence of the defects is investigated using such a classified result as described to measure the production line early, thus enabling prevention of lowering of a yield of the production line. Accordingly, it is possible to shorten the feedback time of the analyzed results to the production line including the time of classification operation to prevent the lowering of a yield of the production line.

According to the present invention, the efficiency of the classification operation is realized by improving a

user's interface, thus enabling the shortening of the analysis time and the enhancement of the analysis accuracy.

WHAT IS CLAIMED IS:

1. An inspecting system comprising an analyzing unit, said analyzing unit including an image detection device for photographing a plurality of images in a workpiece; a storage means for storing detected images detected by said image detection device; and a display means having a first area for displaying a plurality of detected images stored in said memory means and a plurality of second areas for classifying said detected images according to features of said detected images; wherein said plurality of detected images can be moved on a screen from said first area to said corresponding second areas to classify said plurality of detected images in said second areas.
2. An analyzing unit comprising a storage means for storing a plurality of detected images; and a display means having a first area for displaying a detected image stored in said storage means and a plurality of second areas for classifying said detected images according to features of said detected images; wherein said plurality of detected images can be moved on a screen from said first area to said corresponding second areas to classify said plurality of detected images in said second areas.
3. A method for manufacturing an electronic device wherein use is made of a manufacturing apparatus for processing a workpiece to be an electronic device; an

inspecting apparatus for inspecting the workpiece processed by said manufacturing apparatus; and an analyzing unit including an image detection device capable of photographing an image of said workpiece, a storage means for storing detected images detected by said image detection device, and a display means having a first area for displaying a detected image stored in said storage means and a plurality of second areas for classifying said detected images according to features of said detected images, whereby said plurality of detected images can be moved on a screen from said first area to said corresponding second areas to classify said plurality of detected images in said second areas; wherein the production line having said manufacturing apparatus arranged thereon is controlled using information obtained from said analyzing unit to process the workpiece.

ABSTRACT OF THE DISCLOSURE

The present invention has an analyzing unit including an image detection device for photographing a plurality of images in a workpiece, a storage means for storing detected images detected by said image detection device, and a display means having a first area for displaying a plurality of detected images stored in the storage means and a plurality of second areas for classifying the detected images according to features of the detected images, whereby said plurality of detected images can be moved on a screen from the first area to the second corresponding areas to classify the plurality of detected images in the second areas.

FIG. 3

100 Inspection/image detection device defect
image
301 Coordinate of detected defect image is
related to defect image for storage
302 Calculate features of detected image
303 Transmit image information to storage unit
304 Obtain image information
305 Display unclassified image
306 Prepare classification area 152
307 Move typical image from unclassified image
display area
108 Move image to applicable classification area
109 Update category of internal data

FIG. 4

- 1 Defect number
- 2 Coordinate X
- 3 Coordinate Y
- 4 Classification category
- 5 Operating data and time
- 6 Image name
- 7 Features
- 8 Unclassified

FIG. 6 (b)

- 1 Category name
- 2 Area coordinate
- 3 Attached image
- 4 Unclassified
- 5 White

FIG. 7 (b)

- 1 Category name
- 2 Area coordinate
- 3 Attached image
- 4 Unclassified
- 5 White

FIG. 8 (b)

- 1 Category name
- 2 Area coordinate
- 3 Attached image
- 4 Unclassified
- 5 White

FIG. 9

- 1 Category name
- 2 Area coordinate
- 3 Attached image
- 4 Unclassified
- 5 White

6 Black
7 Elongated
8 Large

FIG. 11

1 Defect number
2 Coordinate X
3 Coordinate Y
4 Classification category
5 Operating data and time
6 Image name
7 Features
8 White
9 Black
10 Elongated
11 Large
12 White
13 Large
14 Elongated
15 Black
16 Elongated
17 White
18 Elongated
19 White
20 Black
21 Large

22 Black
23 Black
24 White
25 White
26 Elongated
27 Black

FIG. 12

401 Display unclassified image
402 Automatic classification processing
403 Calculate categories
404 Move image to corresponding category area
405 Classification of all images completed ?
206 Indicate image (click by mouse)
207 Classification area exist ?
208 Add new category
209 Move image to corresponding category area
410 Classification of all images completed ?
211 Confirm classified results
213 Update category of internal data

FIG. 14

1 Gray-scale value
2 Area

FIG. 16

1	Category
2	Number of occurrence
3	Rate
4	White
5	Black
6	Elongated
7	Large

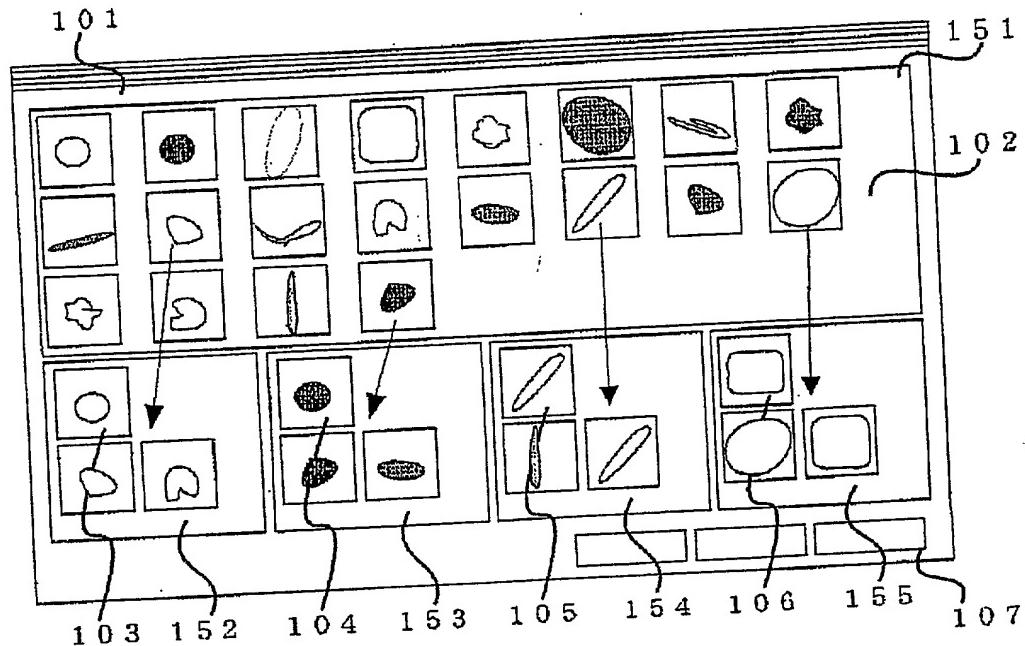
出願書類

ファイル名 = D98010441A1.e1

【書類名】 図面

【図1】

図1

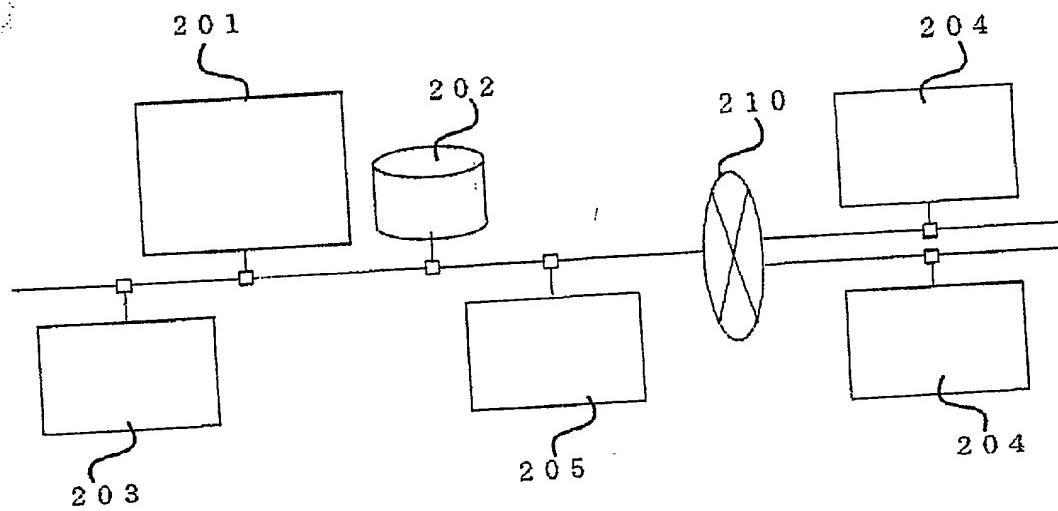


出願書類

ファイル名 = D98010441A1.e1

【図 2】

図 2



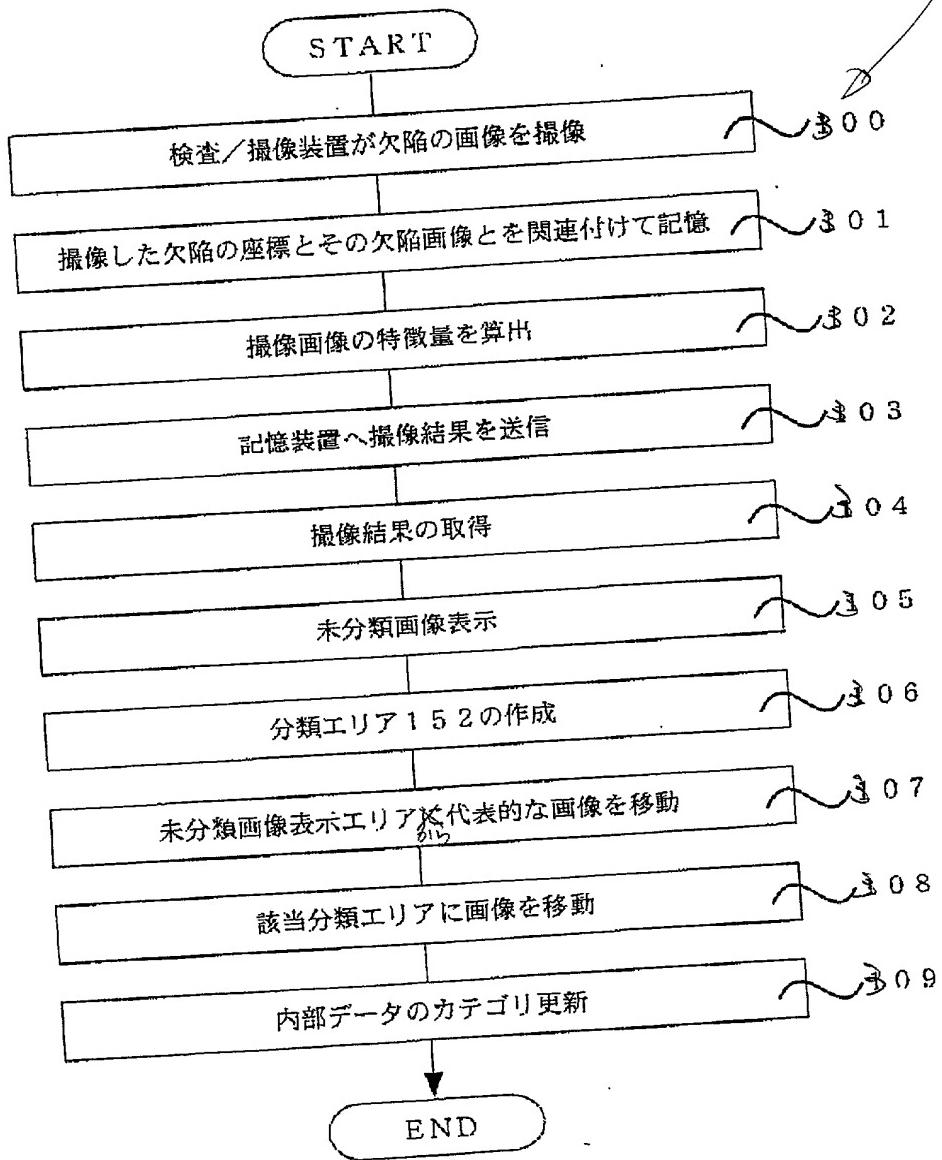
出願書類

ファイル名 = D98010441A1.e1

【図3】

図3

300番台



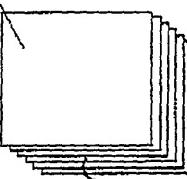
ファイル名 = D98010441A1.e1

【図4】

図4

欠陥番号	座標X	座標Y	分類カテゴリ	作業日時	画像名	特徴量
00001	10	10	未分類	0000/00/00 00:00:00	IMG001	000,0030,00
00002	10	30	未分類	0000/00/00 00:00:00	IMG002	250,0030,00
00003	00	50	未分類	0000/00/00 00:00:00	IMG003	000,0050,01
00004	00	70	未分類	0000/00/00 00:00:00	IMG004	000,0700,00
00005	00	90	未分類	0000/00/00 00:00:00	IMG005	000,0040,00
00006	50	10	未分類	0000/00/00 00:00:00	IMG006	000,1000,00
00007	50	30	未分類	0000/00/00 00:00:00	IMG007	000,0500,01
00008	50	50	未分類	0000/00/00 00:00:00	IMG008	230,0050,00
00009	50	70	未分類	0000/00/00 00:00:00	IMG009	245,0040,01
00010	50	90	未分類	0000/00/00 00:00:00	IMG010	010,0035,00
00011	100	10	未分類	0000/00/00 00:00:00	IMG011	005,0055,01
00012	100	30	未分類	0000/00/00 00:00:00	IMG012	020,0060,00
00013	100	50	未分類	0000/00/00 00:00:00	IMG013	200,0030,00
00014	100	70	未分類	0000/00/00 00:00:00	IMG014	150,0300,01
00015	100	90	未分類	0000/00/00 00:00:00	IMG015	190,0045,00
00016	150	10	未分類	0000/00/00 00:00:00	IMG016	220,1200,00
00017	150	30	未分類	0000/00/00 00:00:00	IMG017	000,0035,00
00018	150	50	未分類	0000/00/00 00:00:00	IMG018	010,0045,00
00019	150	70	未分類	0000/00/00 00:00:00	IMG019	150,0020,01
00020	150	90	未分類	0000/00/00 00:00:00	IMG020	200,0035,00

601



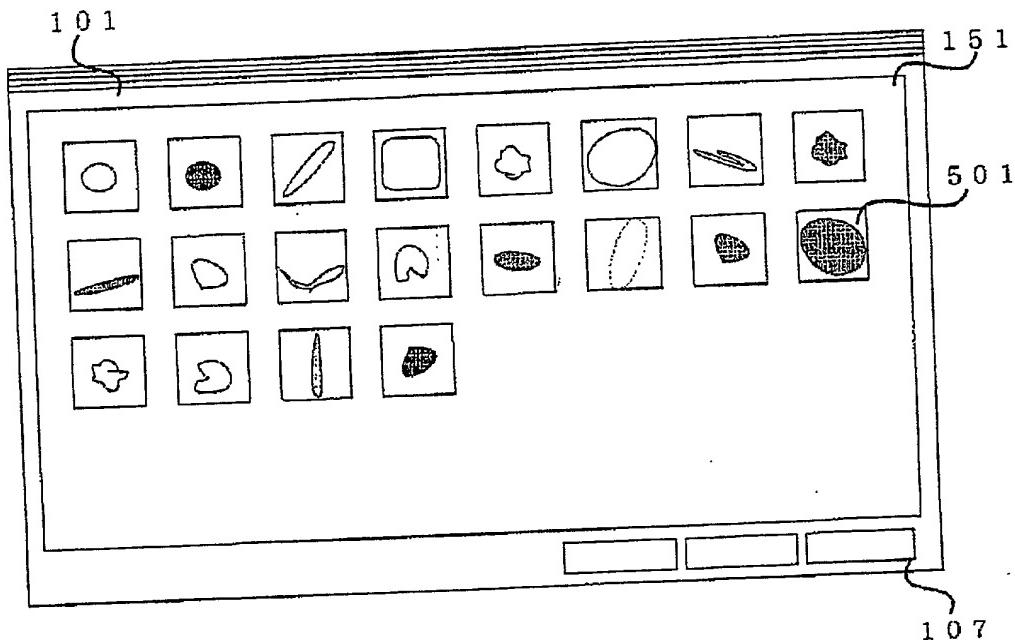
602

出願書類

ファイル名 = D98010441A1.e1

【図 5】

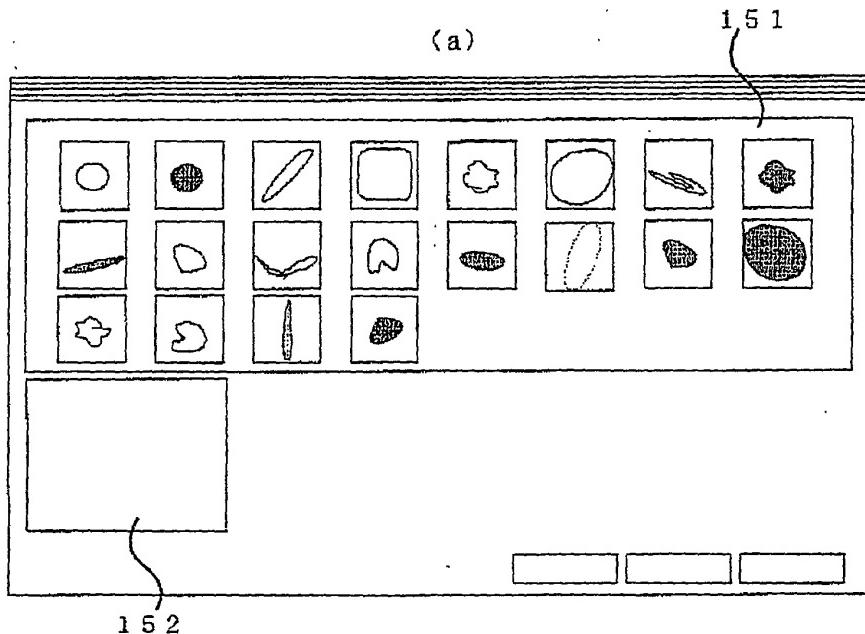
図 5



ファイル名 = D98010441A1.e1

【図 6】

図 6



(b)

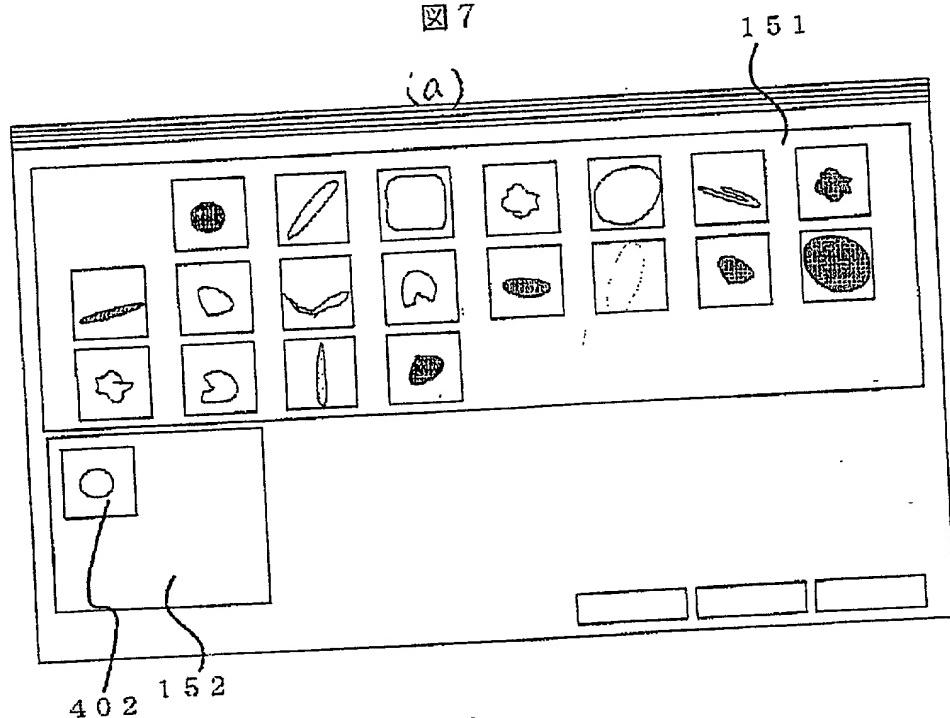
カテゴリ名	エリア座標	所属画像
未分類	(000010, 000020) (000150, 000400)	IMG001, IMG002, ...
白	(000160, 000020) (000220, 000100)	

出願書類

ファイル名 = D98010441A1.el

【図 7】

図 7



(b)

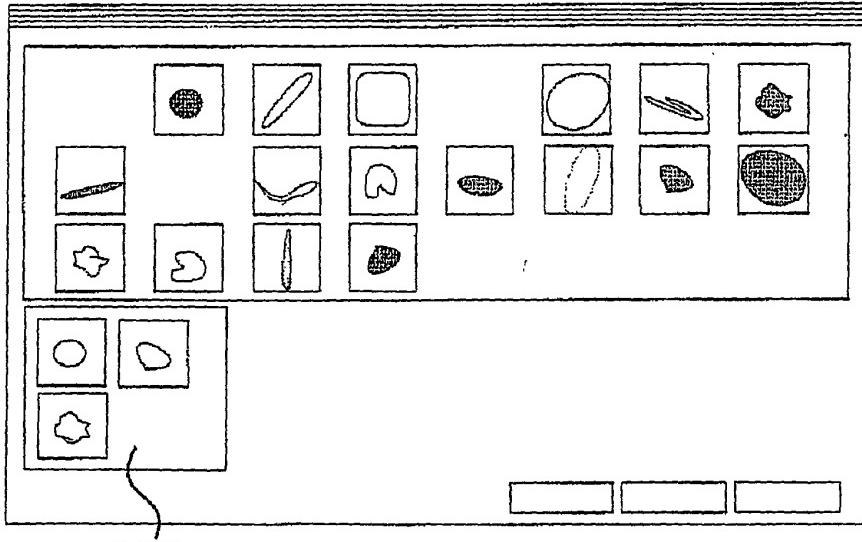
カテゴリ名	エリア座標	所属画像
未分類	(000010, 000020) (000150, 000400)	IMG002, IMG003,
白	(000160, 000020) (000220, 000100)	IMG001

ファイル名 = D98010441A1.e1

【図 8】

図 8

(a)



152

(b)

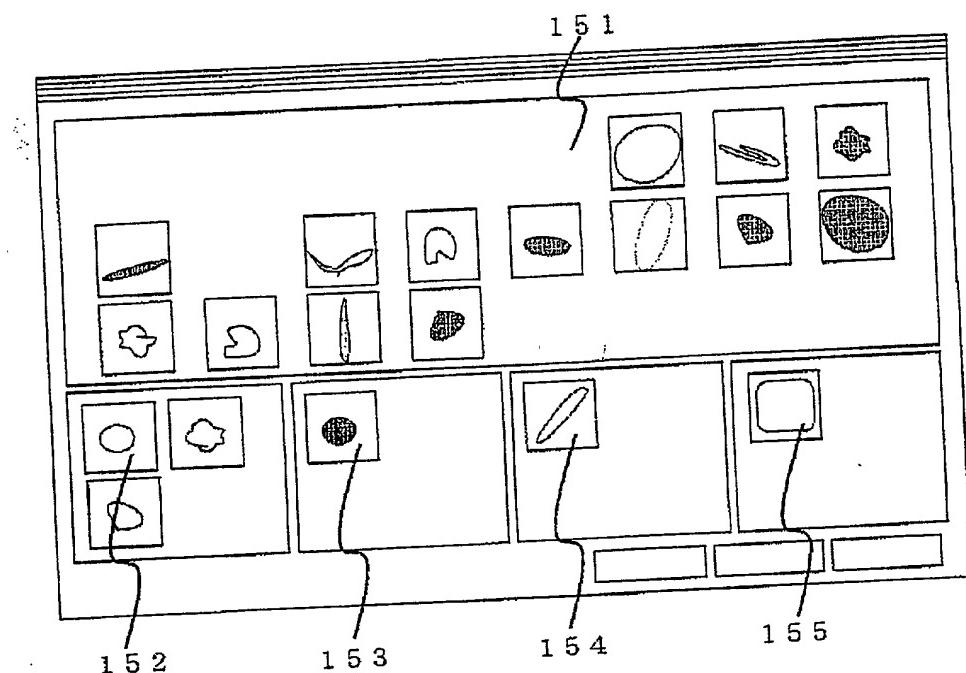
カテゴリ名	エリア座標	所属画像
未分類	(000010, 000020) (000150, 000400)	IMG002, IMG003,
白	(000160, 000020) (000220, 000100)	IMG001, IMG005, IMG010

出願書類

ファイル名 = D98010441A1.e1

【図9】

図9



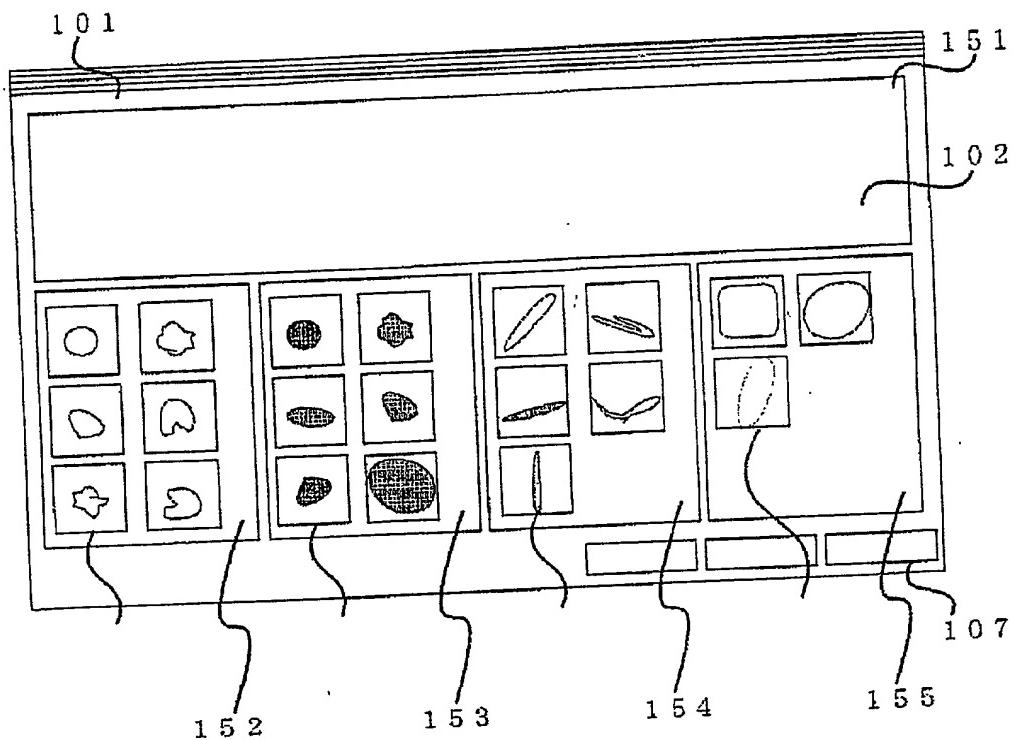
カテゴリ名	エリア座標	所属画像
未分類	(000010, 000020) (000150, 000400)	IMG006, IMG007.....
白	(000160, 000020) (000220, 000100)	IMG001, IMG005, IMG010
黒	(000160, 000120) (000220, 000200)	IMG002
細長	(000160, 000220) (000220, 000300)	IMG003
大	(000160, 000320) (000220, 000400)	IMG004

出願書類

ファイル名 = D98010441A1.e1

【図 10】

図 10

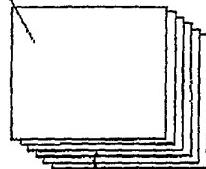


ファイル名 = D98010441A1.e1

【図 1 1】

図 1 1

欠陥番号	座標 X	座標 Y	分類カテゴリ	作業日時	画像名	特徴量
00001	10	10	白	1997/01/01 00:00:01	IMG001	000,0030,00
00002	10	30	黒	1997/01/01 00:00:02	IMG002	250,0030,00
00003	10	50	細長	1997/01/01 00:00:03	IMG003	000,0050,01
00004	10	70	大	1997/01/01 00:00:04	IMG004	000,0700,00
00005	10	90	白	1997/01/01 00:00:05	IMG005	000,0040,00
00006	50	10	大	1997/01/01 00:00:06	IMG006	000,1000,00
00007	50	30	細長	1997/01/01 00:00:07	IMG007	000,0500,01
00008	50	50	黒	1997/01/01 00:00:08	IMG008	230,0050,00
00009	50	70	細長	1997/01/01 00:00:09	IMG009	245,0040,01
00010	50	90	白	1997/01/01 00:00:10	IMG010	010,0035,00
00011	100	10	細長	1997/01/01 00:00:11	IMG011	005,0055,01
00012	100	30	白	1997/01/01 00:00:12	IMG012	020,0060,00
00013	100	50	黒	1997/01/01 00:00:13	IMG013	200,0030,00
00014	100	70	大	1997/01/01 00:00:14	IMG014	150,0300,01
00015	100	90	黒	1997/01/01 00:00:15	IMG015	190,0045,00
00016	150	10	黒	1997/01/01 00:00:16	IMG016	220,1200,00
00017	150	30	白	1997/01/01 00:00:17	IMG017	000,0035,00
00018	150	50	白	1997/01/01 00:00:18	IMG018	010,0045,00
00019	150	70	細長	1997/01/01 00:00:19	IMG019	150,0020,01
00020	150	90	黒	1997/01/01 00:00:20	IMG020	200,0035,00

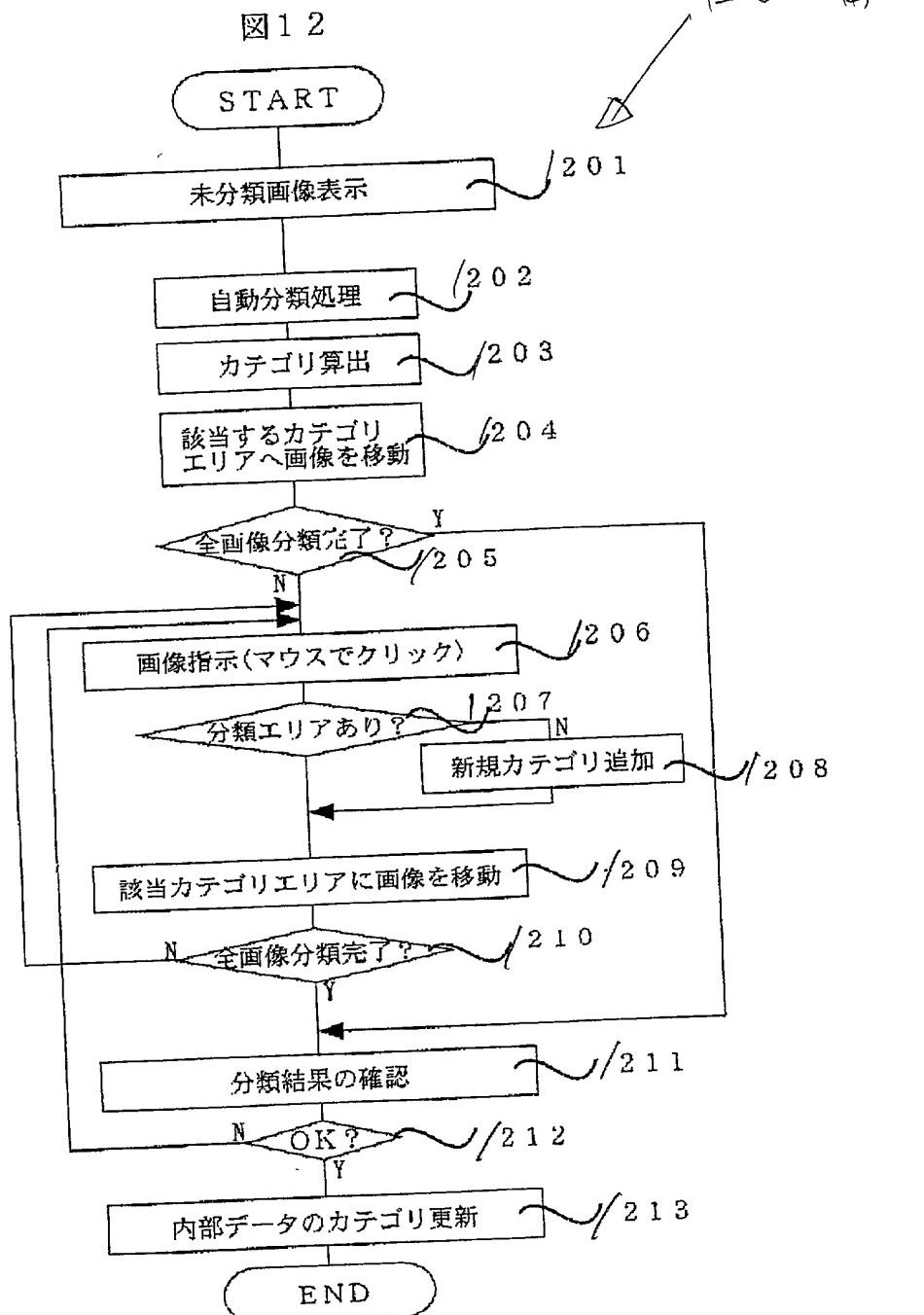


602

出願書類

ファイル名 = D98010441A1.e1

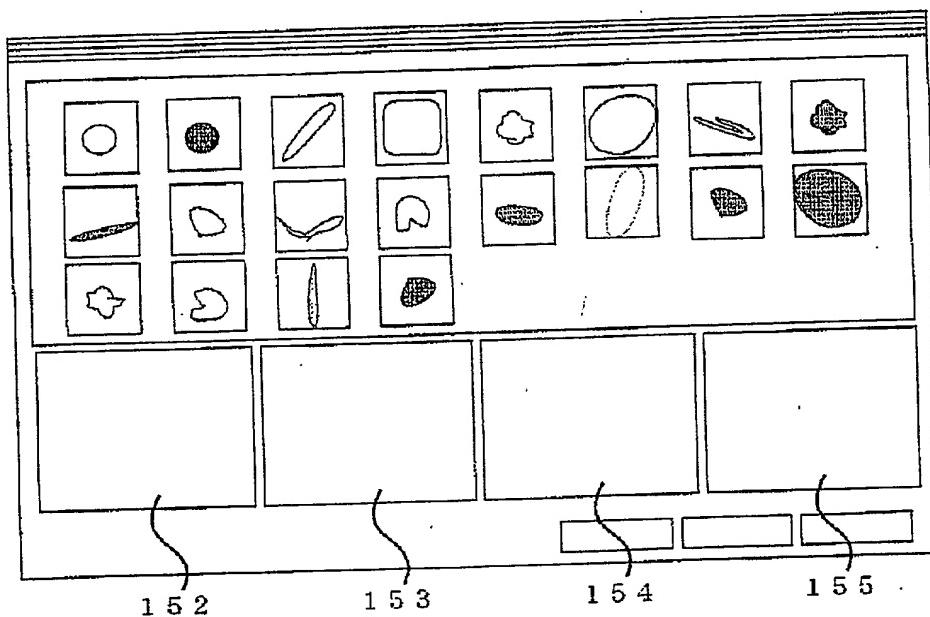
【図 12】



ファイル名 = D98010441A1.e1

【図 1 3】

図 1 3

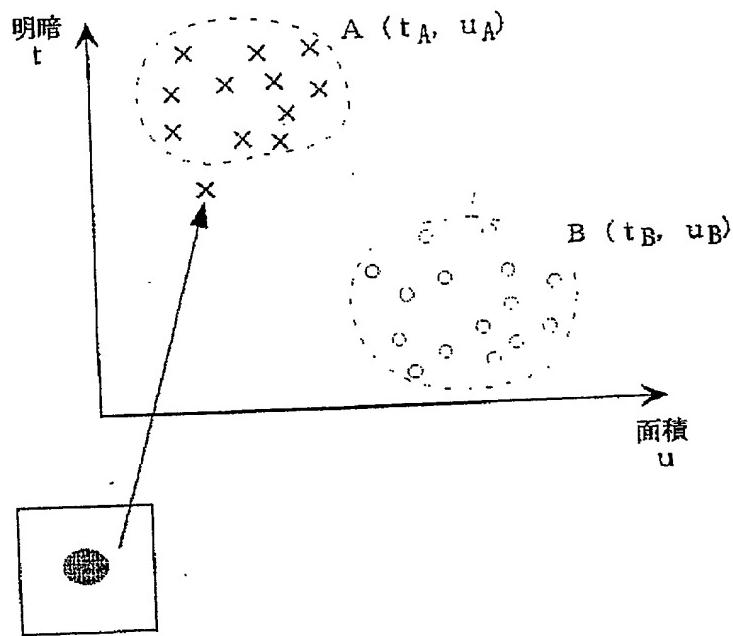


出願書類

ファイル名 = D98010441A1.e1

【図 14】

図 14

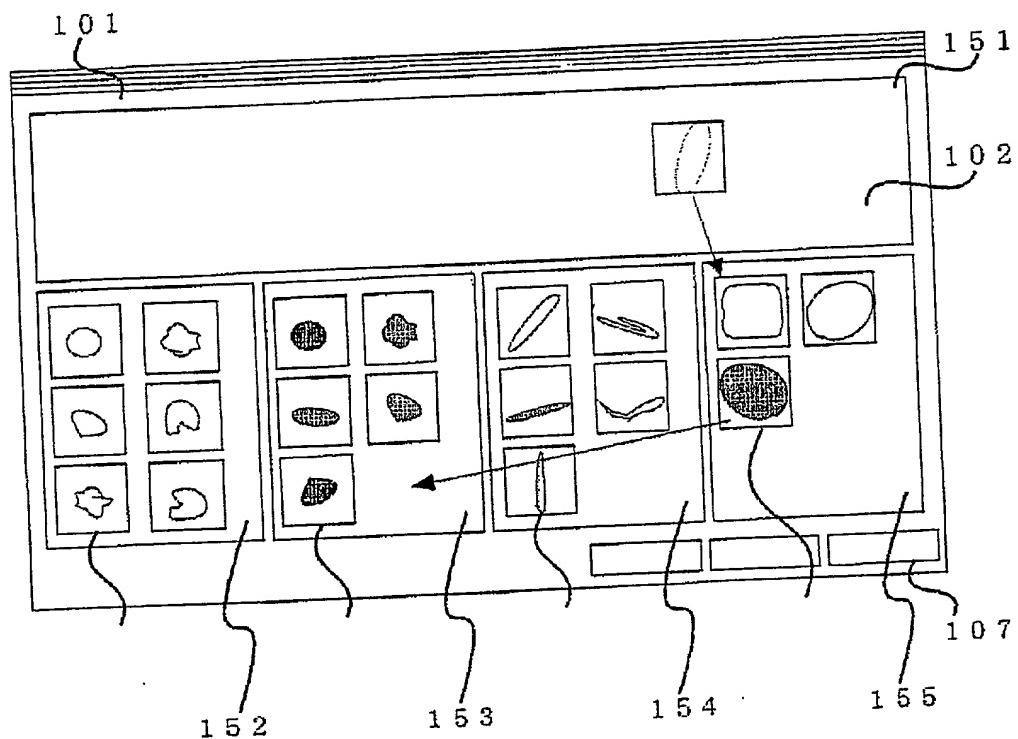


出願書類

ファイル名 = D98010441A1.e1

【図 15】

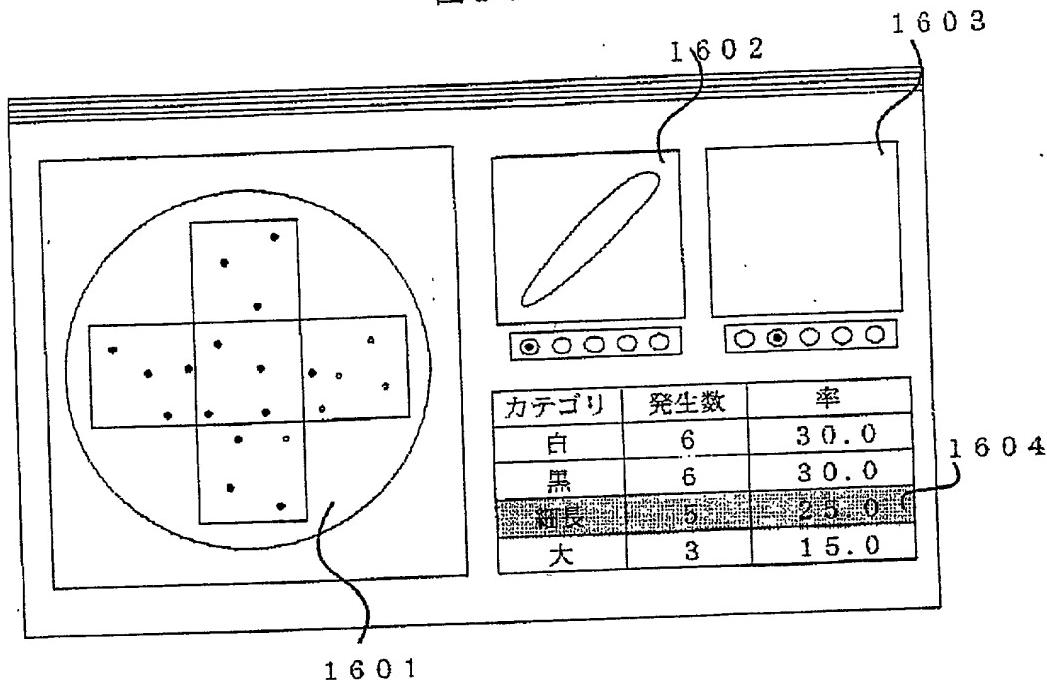
図 15



ファイル名 = D98010441A1.e1

【図 16】

図 16



DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

" INSPECTING METHOD, INSPECTING SYSTEM, AND METHOD FOR

MANUFACTURING ELECTRONIC DEVICES "

the specification of which (check one) is attached hereto.

was filed on _____
as Application Serial No. _____
and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

P10-341991 (Number)	Japan (Country)	1/12/1998 (Day/Month/Year Filed)	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)

I hereby appoint as principal attorneys; Donald R. Antonelli, Reg. No. 20,296; David T. Terry, Reg. No. 20,178; Melvin Kraus, Reg. No. 22,466; Stanley A. Wal, Reg. No. 26,432; William I. Solomon, Reg. No. 28,565; Gregory E. Montone, Reg. No. 28,141; Ronald J. Shore, Reg. No. 28,577; Donald E. Stout, Reg. No. 26,422; Alan E. Schiavelli, Reg. No. 32,087; James N. Dresser, Reg. No. 22,973 and Carl I. Brundidge, Reg. No. 29,621 to prosecute and transact all business connected with this application and any related United States application and international applications. Please direct all communications to the following address:

Antonelli, Terry, Stout & Kraus
Suite 1800
1300 North Seventeenth Street
Arlington, Virginia 22209
Telephone: (703) 312-6600
Fax: (703) 312-6666

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United State Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(Full Name)

(Signature)

Date November 22, 1999 Inventor Yoko IKEDA

Yoko Ikeda

Residence Same as post office address Citizenship Japan
Post Office Address Eko Haitsu Kitami #206, 819-1 Maioka-cho, Totsuka-ku,
Yokohama-shi, Kanagawa-ken, Japan

Date November 22, 1999 Inventor Junko KONISHI

Junko Konishi

Residence Same as post office address Citizenship Japan
Post Office Address A-215, 4526-1, Totsuka-cho, Totsuka-ku, Yokohama-shi, Kanagawa-
ken, Japan

Date November 22, 1999 Inventor Hisafumi IWATA

Hisafumi Iwata

Residence Same as post office address Citizenship Japan
Post Office Address 488-18, Isshiki, Hayama-machi, Miura-gun, Kanagawa-ken, Japan

Date November 22, 1999 Inventor Yuji TAKAGI

Yuji Takagi

Residence Same as post office address Citizenship Japan
Post Office Address Obel Kamakura Ueki 904, 425-1, Ueki, Kamakura-shi, Kanagawa-ken
Japan

Date November 22, 1999 Inventor Kenji OBARA

Kenji Obara

Residence Same as post office address Citizenship Japan
Post Office Address Hitachi Fujimi-ryo #301, 1545, Yoshida-cho, Totsuka-ku,
Yokohama-shi, Kanagawa-ken, Japan

Date November 22, 1999 Inventor Ryo NAKAGAKI

Ryo Nakagaki

Residence Same as post office address Citizenship Japan
Post Office Address Park hills Saginuma 2 bankan #404, 4-10, Tsuchihashi 4-chome,
Miyamae-ku, Kawasaki-shi, Kanagawa-ken, Japan

Date November 23, 1999 Inventor Seiji ISOGAI

Seiji Isogai

Residence Same as post office address Citizenship Japan
Post Office Address 2525-146, Mawatari, Hitachinaka-shi, Ibaraki-ken, Japan

Date November 23, 1999 Inventor Yasuhiko OZAWA

Yasuhiko Ozawa

Residence Same as post office address Citizenship Japan
Post Office Address 24-604, Izumi 9-chome, Abiko-shi, Chiba-ken, Japan

Date _____ Inventor _____

Residence _____ Citizenship _____

Post Office Address _____

Date _____ Inventor _____

Residence _____ Citizenship _____

Post Office Address _____